Desalination

The purpose of this section is to provide an estimate of the potential for using desalination to help meet California's water needs. Only desalination for municipal purposes, that is, desalination used by public and private water agencies is considered. Desalination by industrial and commercial entities is not considered. Desalination plant capacity for this report is expressed in terms of the fresh or potable water capacity of the plant. Total water costs are given in dollars per acre-foot of fresh or potable water produced.

Desalination is a water treatment process for the removal of salt from water for beneficial use. Desalination is used on brackish (low-salinity) water as well as seawater. In California, the principal method for desalination is reverse osmosis. This process can be used to remove salt in general as well as specific contaminants in water such as Trihalomethane precursors, for example.

Current status

Desalination began in California in 1965. The last decade has seen a rapid rise in installed capacity. This has occurred due mostly to dramatic improvements in membrane technology and the increasing cost of conventional water supply development. Desalination installed capacity in California in 1999 was approximately 150,000 acre-feet per year of water from more than 150 plants, the majority of which are small industrial plants. The 30 plants that are used for municipal purposes, total about 80,000 acre-feet per year in capacity, more than half of the total water capacity.

In September 2002, Gov. Gray Davis signed into law Assembly Bill 2717 that called for DWR to establish a Desalination Task Force. By July 1, 2004, the Task Force will report to the Legislature about:

- Potential opportunities for desalination of seawater and brackish water in California
- Impediments to using desalination technology
- What role, if any, the state should play in furthering the use of desalination

Metropolitan District of Southern California (MWD) has recently developed plans to expand its Local Resources Program, which provides a subsidy of up to $250 per acre-foot to its member agencies to encourage the development of municipal wastewater recycling and groundwater recovery,

Sources

- *Water Desalination Task Force (AB 2717 [Hertzberg, Chapter 957, Statues of 2002])*
- *Draft Desalination Issues Assessment Report, Center for Collaborative Policy, California State University, May 2003*
- *"Desalting in California", Division of Planning & Local Assistance, San Joaquin District (in preparation)*
- *"Seawater Desalination in California", California Coastal Commission (in preparation)*
- *"Seawater Desalination: Opportunities and Challenges", National Water Research Institute, March 2003.*
- *"Tapping the World's Largest Reservoir: Desalination", Western Water, January/ February 2003*

and to encourage the development of seawater desalination. The district has increased its goal for seawater desalination from 50.000 acre-feet per year to 150,000 acre-feet per year. San Diego County Water Authority is also investigating seawater desalting facilities in addition to the 50 mgd Carlsbad plant proposed under the MWD program described above. A number of San Francisco Bay Area agencies are jointly funding planning studies for desalination, as are several central coastal agencies.

Potential benefits of municipal desalination

The primary benefit of desalting is to increase California's water supply. Seawater desalting taps the significant supply of feedwater from the Pacific Ocean. Desalting wastewater increases the range of beneficial uses for which recycled municipal wastewater can be used (see water recycling management strategy). Desalting groundwater allows groundwater of impaired quality to be adequately treated for potable use.

The nearby table shows the number and capacity of plants in operation and in design and construction as of 2002 and plants planned or projected to be in operation by 2030.

In regard to desalting, new water is defined as the product water from desalting a feedwater that comes from a salt sink such as the ocean or a water that would normally flow to a salt sink. Seawater is the most obvious source of new water produced by desalting. Groundwater and other brackish water sources may or may not be a "new" water supply depending upon the local situation. The estimates or wastewater desalting are only for information. The capacity is included in the wastewater reclamation estimates elsewhere in this report.

There is about 185,000 acre-feet per year of "new water" potential from desalination in California by 2030. This estimate reflects only seawater as a feedwater source. Total desalting capacity by 2030 is estimated to be about 469,000 acre-feet per year.

In addition to the above, there is additional water production possible from desalting oil field production water in the San Joaquin and Salinas Valleys and brackish agricultural drainage water in the San Joaquin and Imperial Valleys.

In many areas of the state, desalting can provide a new source of supply, reclaim water that would be lost to a salt sink, or extend the use of existing supplies and reduce the need for additional inter-basin transfers of water.

In summary, the benefits that desalination can provide are:

- Increase in water supply
- Reclamation and beneficial use of waters of impaired quality
- Increased water supply reliability during drought periods
- Diversification of water supply sources
- Improved water quality
- Protection of public health

Potential costs

Recent technological advances in various desalination processes have significantly reduced the cost of desalinated water to levels that are comparable, and in some instances competitive, with other alternatives for acquiring new water supplies. Desalination technologies are becoming more efficient, less energy demanding and less expensive. Significant progress and innovation in membrane technologies such as reverse osmosis has helped reduce costs. The RO process has been proven to produce high quality drinking water throughout the world for decades.

The estimated capital cost of 258,500 acre-feet per year in increased capacity ranges from $750-1,250 million depending upon the mix of groundwater, wastewater and seawater plants. The plants currently under construction represent a total (without subsidies) investment of approximately $700 million. The table below shows the range in total unit water cost that can be expected from plants desalting groundwater (or brackish), wastewater and seawater. These costs are based on the expected lifetime of the plant (20-30 years).

Major issues

Historically, the cost of desalting has been the major issue regarding desalting, with energy use a close second. As desalting costs have declined and the cost of traditional water supplies has increased, desalting is increasingly being considered. As a result, two additional issues have increased importance, environmental impacts and permitting (particularly for coastal plants).

Cost and affordability – Desalination has historically been prohibitively expensive. The improvements in technology and the rising cost of conventional water supplies has made desalination competitive with importing water and recycled municipal wastewater in a number of cases. Cost is still an issue to consumers. The cost will be influenced by the type

of feedwater, the available concentrate disposal options, the proximity to distribution systems, and the availability and cost of power. The higher costs of desalting may, in some cases, be offset by the benefits of increased water supply reliability and/or the environmental benefits from substituting desalination for a water supply with higher environmental costs (e.g. Carmel River, Monterey Bay area).

Environmental impact and permitting – Brackish water desalination plants have fairly routine environmental and permitting requirements. Coastal desalination plants will, and do, face much closer scrutiny. With a location within the coastal zone, and with the need for water intake and outfall methods, there will be a considerable number of reviewing agencies and organizations.

Seawater intakes – Open ocean intake systems are the proposed source of feedwater for coastal desalination plants now being studied. Existing seawater intake systems for power plant cooling are proposed as the source of supply for almost all of the currently proposed plants. In general, these existing intake systems have been shown to have fairly significant impacts on the coastal zone. A number of coastal power plants may that use once-through cooling from the ocean, may cease operation or convert to a "dry" cooling system. In addition, some plants are not in continuous operation. These may limit the potential capacity of seawater desalting on the coast.

Concentrate discharge - Desalination plants of any type produce a salt concentrate that must be discharged. The quantity and salinity of that discharge varies with the type of desalting plant and its operation. Brackish water plants in California, discharge their concentrate to municipal wastewater treatment systems where they are treated and blended with effluent prior to discharge. For brackish water plants, this type of discharge is likely to continue. Inland desalting plants without a discharge to the ocean may be limited by the type of discharge options available. Seawater desalination produces a concentrate approximately twice as salty as seawater. In addition, residuals of other treatment chemicals may also be in the concentrate. The plants currently being planned are to utilize existing power plant outfall systems to take advantage of dilution and mixing prior to discharge. Studies have been conducted for a number of proposed coastal desalination plants and others are currently underway. The availability of power plant cooling systems to dilute the concentrate prior to discharge to the ocean will also be affected by the future of coastal power plants as discussed in the prior section.

Energy use – Desalination's primary operation cost is for power. A 50 mgd seawater plant (approximately 50,000 acre-feet per year) would require about 33 MW of power. Seawater desalination developed as forecast to 185,000 acre-feet per year would require about 123 MW of power. The Moss Landing Power Plant in the Monterey Bay area, for example, has four power generation units producing a total of 2,530 MW. Seawater desalination developed at the forecast capacity would require the output of about 1/3 of one unit. The reduction in unit energy use has been among the most dramatic improvements in recent years due to improvement in energy recovery systems.

Growth-inducing impacts – In a number of locations, primarily coastal communities, the availability of water has been a substantial limitation on development. Desalination on the coast is now a much more affordable option in comparison to the past. The lack of water will no longer be as strong a constraint on coastal development as it once was. Population growth along the coast will lead to increasing pressure on coastal zone resources.

Recommendations

Recommendations may be forthcoming from the statewide Water Desalination Task Force.